

### REMARKS

Claims 58-68 are pending in the application with claims 1-57, 69-98, and 100-108 being withdrawn in view of the Restriction Requirement mailed September 26, 2006. Claims 58-68 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Claims 58-68 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claims 58-68 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Reiss et al., *Nano Letters*, 2, (7), 781-784 (2002) (hereinafter "Reiss") in view of United States Patent 4,675,207 to Nicolau (hereinafter "Nicolau"). Claims 58-68 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Reiss in view of Nicolau and further in view of Li et al., *Journal of the American Chemical Society* (9/23/2003, volume 125, pages 12567-12575) (hereinafter "Li"). Claims 58-68 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Reiss in view of United States Patent 5,300,793 to Kondow et al. (hereinafter "Kondow") and Nicolau (hereinafter "Nicolau") for the reasons of record set forth in paragraph 3 of the Office Action mailed on April 2, 2007.

Applicant respectfully requests reconsideration of the present application in view of the following Remarks.

#### Claims 58-68 and 35 U.S.C. § 112, First Paragraph

Claims 58-68 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Specifically, the Examiner states that the recitation "resulting in a mixture comprising the solution of core nanocrystals, the cation precursor solution and the anion precursor solution" was not described in the specification in such a way to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

Applicants respectfully assert that numerous sections of the specification, including page 5, lines 26-29 and page 64, lines 24-31, and the originally filed claims, including claims 58-68, describe adding, in an alternating manner, cation and anion precursor solutions to a solution of core nanocrystals. Adding cation and anion precursor solutions to a solution of core nanocrystals results in the formation of a mixture

comprising the solution of core nanocrystals, cation precursor solution and anion precursor solution. This mixture is formed whether or not the core nanocrystals are coated. The present claims do not require *uncoated* core nanocrystals in the mixture as suggested by the Examiner. As a result of the support provided by the specification and claims, Applicants respectfully assert that claims 58-68 are compliant with the written description requirement of § 112, first paragraph, and respectfully request that the present rejection be withdrawn.

Claims 58-68 and 35 U.S.C. § 112, Second Paragraph

Claims 58-68 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Specifically, the Examiner states:

Language of claims 58 and 59 is confusing because it is not clear how after covering the core nanocrystals with a monolayer of cation, the core nanocrystals are still present by the time of adding the anion precursor.<sup>1</sup>

Definiteness of claim language must be analyzed, not in a vacuum, but in light of several factors including the claim interpretation that would be given by one possessing the ordinary level of skill in the art and the content of the particular application disclosure.<sup>2</sup>

As understood by one of skill in the art and as set forth in the present specification, in order to form a shell on a core nanocrystal, cationic species and anionic species are required. Cationic species are clearly set forth in the specification and pending claims as M while anionic species are clearly set forth as X. Deposition of a monolayer of cation on a core nanocrystal does not destroy the core nanocrystal or render it unavailable to receive the anionic species for reaction with the cationic species to form a shell. Depositing a monolayer of cation on a core nanocrystal alone does not form a shell as contemplated by the present claims.

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<sup>1</sup> April 22, 2008 Office Action at page 3.

<sup>2</sup> Manual of Patent Examining Procedure § 2173.02.

The scope of the claims is clear to one of skill in the art in that both cationic and anionic species are required to form a shell over a nanocrystal core and that deposition of a cation monolayer or an anion monolayer on a core nanocrystal does not preclude receiving the conjugate species in the formation of the shell layer.

In view of the foregoing, Applicants respectfully assert claims 58-68 are definite under 35 U.S.C. § 112, second paragraph, and respectfully request that the Examiner withdraw the present rejection.

Claims 58-68 and 35 U.S.C. § 103(a)

The rejection of claims 58-68 under 35 U.S.C. § 103(a) as being unpatentable over Reiss in view of Nicolau is respectfully traversed.

As recognized by the Office, Reiss discloses a one-step method for the production of core/shell nanocrystals and thus fails to teach a method wherein a cation precursor solution and an anion precursor solution are added in an alternating manner to a solution of core nanocrystals.<sup>3</sup>

Nicolau likewise does not teach or suggest the alternating application of cation and anion precursor solutions to a solution of core nanocrystals. Nicolau discloses a method of immersing a unitary substrate in various individual salt solutions with rinsing between immersions. The rinsing step required by Nicolau is administered to clear the substrate of excess solution thereby facilitating the formation of at least two superimposed ionic layers.<sup>4</sup> The independent salt solutions and the requirement of rinsing between immersions preclude Nicolau from teaching or suggesting a method, as recited in the independent claims 58 and 59, wherein a mixture comprising a solution of core nanocrystals, a cation precursor solution, and an anion precursor solution is formed.

Additionally, it is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 218 USPQ 769 (Fed Cir. 1983) and MPEP § 2145.X.D.2. The one-step, simultaneous combination of cation and anion species described by Reiss teaches away from the alternating immersion steps of Nicolau. Moreover, Reiss further teaches away from Nicolau by providing a plurality of

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<sup>3</sup> April 22, 2008 Office Action at page 4.

<sup>4</sup> Nicolau, Column 4, lines 20-23 and Column 5, lines 9-12.

nanocrystalline substrates. A plurality of nanocrystalline substrates is fundamentally inconsistent with the large unitary substrates of Nicolau having surface areas of 10 to 1,000 cm.<sup>2</sup>

Furthermore, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). As recognized by the Office Action, Reiss discloses a one-step method for the production of core/shell nanocrystals having high photoluminescent efficiency. The one-step method comprises slowly injecting a mixture of a solution of ZnO complexed with dodecylphosphonic acid or zinc stearate in toluene as the zinc precursor and a solution of TOPSe in TOP into a solution of CdSe nanocrystals.<sup>5</sup> According to Reiss, the foregoing reagents were carefully chosen to effectuate the single-step synthesis of shells on core nanocrystals.<sup>6</sup>

Modification of Reiss' one-step method wherein cation and anion precursor solutions are simultaneously injected with Nicolau's teachings to arrive at a multi-step method consistent with that of the present invention, wherein cation and anion precursor solutions are added in an alternating fashion, changes the principle by which Reiss operates. Addition of cation and anion precursor solutions together and simultaneously is fundamentally different in operation and teaches away from immersing a substrate in separate cation and anion precursor solutions with rinsing between immersions.

Because modifying Reiss with Nicolau changes the principle of operation of Reiss, Applicants respectfully assert that the teachings of Reiss and Nicolau are not sufficient to render the present claims obvious under § 103(a).

Moreover, the Office Action has failed provide any motivation or suggestion to modify the method of Reiss with Nicolau. As provided above, the Office Action states that Reiss discloses "a method for preparing CdSe/ZnSe core shell nanocrystals having impressively high photoluminescence (PL) efficiency."<sup>7</sup> In view of the efficacy of Reiss in producing core/shell nanocrystals with highly desirable properties, Applicants

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<sup>5</sup> Office Action mailed April 2, 2007, pages 2-3.

<sup>6</sup> Reiss, Column 1, p. 782.

<sup>7</sup> *Id.* at page 4.

respectfully assert that one of skill in the art would find no motivation to modify the method of Reiss in an attempt to arrive at a method of the present invention.

For the foregoing reasons, Applicants respectfully assert that claims 58-68 are patentable over Reiss in view of Nicolau and respectfully request that the Examiner withdraw the present rejection.

Claims 58-68 and 35 U.S.C. § 103(a)

The rejection of claims 58-68 under 35 U.S.C. § 103(a) as being unpatentable over Reiss in view of Nicolau further in view of the state of the art admitted by Li is respectfully traversed.

Li is an improper prior art reference. The Examiner provides a publication date of September 23, 2003 for Li. The present application claims priority to a provisional application filed January 22, 2003 containing sufficient disclosure of the presently claimed methods. As a result, Applicants respectfully assert that reliance upon Li as a blueprint to find obviousness is improper and request removal of the Li reference.

Moreover, for reasons consistent with those provided in the discussion above, Applicants respectfully assert that claims 58-68 are patentable over Reiss in view of Nicolau and respectfully request that the present rejection be withdrawn.

Claims 58-68 and 35 U.S.C. § 103(a)

Applicants respectfully traverse the maintenance of the rejection of claims 58-68 under 35 U.S.C. § 103(a) as being unpatentable over Reiss in view of Kondow and Nicolau for the reasons set forth in paragraph 3 of the April 2, 2007 Office Action.

As explained above, and in Applicants' earlier responses, Applicants respectfully assert that claims 58-68 are patentable over Reiss in view of Nicolau. Moreover, as previously explained, Kondow fails to cure the deficiencies of Reiss and Nicolau. Kondow is limited to vacuum conditions, and does not address solution phase synthetic techniques.<sup>8</sup> While the Examiner asserts that Nicolau compares his process to vapor phase deposition and deposition in solution,<sup>9</sup> Nicolau only references vapor deposition

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<sup>8</sup> Kondow, Column 4, lines 29-33.

<sup>9</sup> April 22, 2008 Office Action at page 8.

and solution deposition as known processes for crystalline film growth and proceeds with describing the disadvantages of each.<sup>10</sup> Nicolau does not equate vapor phase deposition techniques such as chemical vapor deposition and molecular beam epitaxy with solution phase techniques.

Thus, it is improper for the Office to equate high vacuum synthetic techniques, such as those described by Kondow, with the solution phase synthetic techniques of the present invention.

In view of the foregoing, Applicants respectfully assert claims 58-68 are patentable over Reiss in view of Kondow and Nicolau and respectfully request that the Examiner withdraw the present rejection.

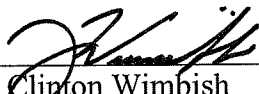
### **CONCLUSION**

In view of the foregoing, a favorable Office Action is respectfully solicited. The Examiner is respectfully invited to contact J. Clinton Wimbish at 704.338.5021 to discuss any matter related to the present application.

Respectfully submitted,

10/21/08  
Date

Kilpatrick Stockton LLP  
Suite 2500  
214 N. Tryon St.  
Charlotte, NC 28202

  
J. Clinton Wimbish  
Reg. No. 54,545

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<sup>10</sup> Nicolau, Column 1, line 24 through Column 2, line 49.